Plenary Session 2–Uses

Q&A

Moderator: Alan Collmer
Cornell University
Ithaca, New York

Steve Pueppke (Michigan State University): This is a deep background question, and I'll be interested to have the panelists' thoughts about it. It's a question of balance, between giving people what they need in terms of food and giving them what they want. And how do we balance the use of technologies with other applications, other things we can do to provide food. What got me thinking about this was that almost every speaker today has shown the same slide, which is the increase in the global population and our obligation to feed all those new mouths. I know that our focus today is on how we may use wonderful technology to do that. Some other people suggest alternative approaches, such as reducing food waste. The numbers I have seen indicate that we could feed another 4 billion people if we could figure out how not to waste the food we produce today. Another issue is whether we grow vegetables and fruits that people eat directly as food or use the land to grow crops for other uses. How do we balance these complexities as scientists and as a society?

Martin Spalding: I can say something about that, although I can't really answer the question. I don't disagree that eliminating food waste is something that we ought to focus some effort on. And there's a valid discussion to have about how much energy should go into various agricultural products. Our group plays a small role in this—to make it possible to produce more food—but I don't think we can have much impact on those other two processes.

Gary Rudgers: Part of that, too, is that there is no single solution. There's a number of solutions, including irrigation, pesticide and farming-equipment availability, along with improved breeding techniques. There are many small parts to the big picture and how each plays in the big picture is difficult to say. Part of it is needing to identify the other solutions, bring them all together and try to more efficiently use technologies.

Le Ann Blomberg: Opportunities for improvements in developed countries are not necessarily applicable to developing countries. Where food is wasted, would it otherwise be possible to transport it to developing countries? What can we do to improve conditions where people need it most? We need to focus on how to address their needs in their environments. It's a complex issue. Part of it is educational in terms of sharing science across the world.

Heather Shearer (Canadian Food Inspection Agency): This question is for Gary. Many speakers have referred to the high cost of preparing a data package for a regulatory submission. However, I think we can agree that a lot of these data would be collected anyway during the course of developing a new submission—molecular characterization, verifying that the plant has desirable agronomics, and so on. I am interested in your perspective on what portions of the data packages may be excessive, or where there might be opportunities to be more efficient.

Rudgers: It depends whether you are looking at mutations versus addition of genes. Part of my concern—especially with mutations—is harmonization in terms of what regulatory agencies are looking for. I am concerned that one country will ask for one type of data, another country will require other types of data and another country will ask for different types of data and the data needs increase over time. When it comes to mutational products, clearly what needs to be done is to put them into the perspective of natural mutations in environments. I don't know if there's going to be a way of having no regulatory oversight, but I would hope that if there is some type of regulatory oversight of mutational products developed with these technologies that they be harmonious and that the data are very basic to address questions of product and not process. It concerns me that countries are trying to regulate the process because it's not the process that results in any safety hazards. The evaluation really needs to be based on the safety of the product and if no risk is attendant on the product there should be little to no regulatory oversight. When it comes to gene addition, hopefully by introducing a trait at a precise location on the genome you can address some regulatory questions upfront. Salient issues are where the gene is located and some of the molecular analysis is straightforward. It depends on the country you are approaching what regulatory data you need. There seems to be general agreement among regulatory agencies internationally that regulatory oversight should be reduced, but no one has proposed what the necessary data might be. I would hope to change the trend of requirement of more and more data and reduce the amount of data required.

Audience Member: Gary, you mentioned CropLife International. Should the crop side and the animal side be working together on CropLife International's mission?

Rudgers: Yes and no. Yes, we should be working together. I think that the regulation of any of these technologies will have impact on the others, whether with animals or with plants. But, they fall into different regulations in different countries and their oversight is very different. I don't know if CropLife International is part of CropLife America. I don't know if there's a similar type of international organization for animals. But, I do feel that, in a sense, we are on the same page of understanding of how these products should be viewed and potentially regulated or not regulated. But, I don't think that any great conversation is going on between the two.

Perry Hackett (University of Minnesota): Gary, something you said earlier—because you use oligos, and they can go almost anywhere, that's considered random mutagenesis and not falling under some of the regulatory guidelines it sounds like. I am thinking, "Why in the world are we breaking our necks to be specific, when what I should be claiming is that we have off-targeting—God know where the off-targeting is—therefore, it's at least semi-random mutagenesis, and don't bother us anymore!"

Rudgers: I agree. An agency asked, "Why do you even come to us if you have mutations and they aren't regulated"? The other problem is, I can guarantee that if, say, Dow Agrosciences generated a mutation in a crop plant and made it available to the public, and Greenpeace found out about it, it would be viewed as a gigantic hazard. It's something that needs to be addressed by the agencies to provide regulatory clarity. But, it is a question of, "Why are we even talking about this?" Then the question becomes, "Do you consider that oligo use should be a regulated technique?", and that's where we seek clarity. At the same time that raises the concern, "Now, do we regulate mutations?"

Ralph Hardy (North American Agricultural Biotechnology Council): We've heard of a number of targets on the animal side, and of a number of targets on the plant side. Some are novel. Many we have heard about in the past. What about the microbial side? Is there opportunity here to do some things? Let's take nitrogen fixation. Problems prevail—high cost of fertilizer input, inefficient use of fertilizer, and so on. There may be bigger impacts on the microbial side of agriculture than on the animal and crop sides we talked about previously.

Spalding: One of my areas of particular interest is algal biotechnology. These technologies could have a big impact on the ability to manipulate eukaryotic algae with regard to their products, their growth potential and any number of opportunities in that arena. The field is largely in its infancy in terms of ability to modify algal genomes, especially in production-type algae. These techniques may facilitate entry into that arena and make a big splash.

Adam Bogdanove (Cornell University): Le Ann, when it comes to genome editing with animals, there's an additional "layer" to regulatory considerations—which you touched on—and that is animal welfare and the ethics of the targets you go after. I was intrigued to hear that some of the target-selection criteria are to improve animal welfare, bringing in favorable traits without dragging along those unfavorable traits that may cause undue suffering. Can you expand on that topic? I don't have a well formed question, but one thing that occurs to me is designer pets. What would the American Kennel Association think about fast-tracking new breeds, such as German Shepherds free of hip dysplasia?

Blomberg: From my own perception, activists don't want certain things to happen, but, on the other hand, it really comes down to the perception of their eating a GMO and that creates another problem. The need is to educate the public and let them know exactly what is being done: is it natural or is it unnatural? What we are trying to address—which I can't talk about as it's in association with a collaborator—I think would be acceptable to industry, but we have to see how it plays out with the public. It's a touchy subject because of people's perception of Frankenfoods, but we need to help people understand what we are trying to do, and the attendant long-term benefits.

Reuben Tayengwa (Washington State University): I am curious as to the reactions of Greenpeace and other anti-GMO people to these new technologies.

Rudgers: On the plant side, it has been relatively quiet, which is good. A group in France has stated that they are against any mutations, implying that we can't eat anything. As products get closer to market there is more conversation about the new technologies, but the objections are not as loud as I anticipated them to be. We have enough time to educate the public. Greenpeace has been good at scaring the public about such products; they can say anything without proof and it's believed. However, on our side—the scientific side—we have a more difficult time relating the science and conveying the importance of science and the role it plays in food. As said, we still have the opportunity to do that, but it's just a matter of time before we are confronted by NGOs.

Alan Collmer: The public's problem lies in dealing rationally with risk versus benefit—every time we get in a plane, a car or an elevator, there it is: a potential risk. But we freely use these vehicles because of the vast benefits. I am wondering if we can shift the public discussion to traits and the benefits that are close to being delivered, particularly with focus on those that are consumer-related, involving improved nutrition and other health benefits.

Rudgers: That's a good point. Recently, while in New Zealand, a government representative asked me, "When will you market a product that's beneficial to the public?" I said that this has been bounded by Greenpeace and individuals who have protested it for years, and despite tremendous potential benefits there hasn't be much success. I agree that we do need to talk about such benefits; it's something that the public will need to accept the technology.

William Serson (University of Kentucky): Do you see the possibility of less opposition from NGOs for the use of these technologies with biofuel crops, which circumvent the "Frankenfood" issue? There has been less resistance to *Bt* cotton because it isn't consumed.

Rudgers: Some say that growing crops that aren't to be consumed is a waste of land, but, yes, there is less opposition to genetically engineered biofuel crops.

Patrick Di Bello (University of Arkansas): Regarding manipulating genes to benefit human nutrition or the environment, how do you sell those to the farmer? Can he market them as specialty crops?

Rudgers: The farmer will grow what will make money. If there is no potential to make money, she or he won't grow it. So, the consumer has to educate the farmer by building demand and including the farmer as part of the process.

Hackett: I want to address two points. Number one, I'll repeat, you can't educate the public. That's what academics talk about—that's what we are all about. We don't do it—deal with that. The second aspect is that a massive experiment has been run here in the United States, wherein a few people stood up to order the bullying and intimidation that we are talking about here. It has to do, actually, with transgenic animals that are on sale in forty-nine out of fifty states; they're called GloFish®. You can't buy then in California because they are genetically engineered pets, and you know how Californians feel about their pets. Apparently, they saved the fresh-water aquarium industry. Walmart, PETSMART, PETCO, these giant chains, wouldn't touch them for the first year or year and a half because they didn't want Greenpeace and others protesting outside their doors. No one protested. You can buy these fish in Walmart, PETSMART and PETCO. It wasn't a big thing. It turned out that these animals had something to offer the consumer who would buy them. They had something to offer the people who were selling them. If you have a competitive product, it will sell. People won't come out and protest; they may buy it.

Hardy: Regarding benefits to consumers—NABC's conference in 2013, on fruits and vegetables, focused in on three or four examples of consumer benefits. The non-browning Arctic® apple was one of those and it seemed to be moving fairly quickly through the regulatory system; it's out for comment at the moment. Another example was *Bt* sweet corn, which doesn't require spraying with insecticide. Simplot's Innate™ potato technology is another good story, as is the means of tackling citrus-greening disease. Will US consumers want orange juice from Brazil, produced without much oversight or from the United States, free of citrus greening thanks to genetic engineering? NABC produced a brief white paper on these examples[1].

[1]http://nabc.cals.cornell.edu/Publications/WhitePapers/SpecialtyCrops.pdf.